



Course Specifications (Postgraduate Degree)

Course Title:	Chemical Separation and Chromatographic Methods
Course Code:	458
Program:	Bachelor's Degree
Department:	Chemistry
College:	Science
Institution:	King Saud University

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A. Course Identification

1. Credit hours: 2 credit hours
2. Course type <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective
3. Level/year at which this course is offered: 7 th or 8 th levels / 4 th year
4. Pre-requisites for this course (if any): 352 Chem. Spectroscopic Analytical Methods & 353 Chem. Electrochemical Methods
5. Co-requisites for this course (if any): No requests

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	15	35
2	Blended		
3	E-learning		
4	Distance learning		
5	Other (practical in laboratory)	28	65

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
1	Lecture	15
2	Laboratory/Studio	28
3	Seminars	
4	Others (specify)	
Total		43

B. Course Objectives and Learning Outcomes

1. Course Description

This course designed and conducted to the related laboratory experiments to give the students the basic principles of the extraction and separation methods. This course covers several traditional and instrumental techniques in separation and chromatographic methods of analysis.

2. Course Main Objective

The main purpose of this course is to help the students to learn and understand several concepts in extraction and separation science. By the end of this course, students expected to:

- Recognize the principles of separation methods
- Be familiar with the separation methods concepts, especially GC and HPLC techniques
- Know the proper separation tool for specific compounds and mixtures
- Learn how to treat with experimental data
- Recognize the specific factors influencing the separation techniques
- To familiarize students with the different chromatographic techniques used in separation of chemical mixtures
- To develop the awareness in the students about the solvent extraction methods

3. Course Learning Outcomes

Course Learning Outcomes (CLOs)		Aligned PLOs*
1	Knowledge and Understanding	
1.1	Recognize the principles of separation methods	K2
1.2	Describe the differences between traditional and instrumental separation techniques	K1
1.3	Outline the most important extraction methods and recognize their principles	K3
1.4	Recall knowledge of the fundamental aspects of the chromatographic techniques	K3
1.5	Define the most useful separation techniques such as GC and HPLC	K3
1.6	Describe the mechanism of separation and elution modes	K1
1.7	Define and describe the most important parameters in the chromatograms resulted from the separation technique	K3
1.8	List the most important application areas for GC and HPLC	K3
1.9	Name the most suitable separation method for specific compounds and matrices	K2
2	Skills	
2.1	Compare and differentiate between separation techniques	S1
2.2	Summarize and diagram the most important components of GC and HPLC systems	S2
2.3	Calculate the most important parameters extracted from separation process	S1
2.4	Interpret and evaluate chromatograms resulted from the separation technique	S2
2.5	Justify the proper separation tool for specific compounds	S3
3	Values	
3.1	Work independently and in group	V3
3.2	Demonstrate and analyze separation problems with group	V1
3.3	Communicate ideas to other students in the laboratory	V2
3.4	Use standard laboratory equipment and modern instrumentation	
3.5	Show leadership and creativity skills	V3
3.6	Use of computer and internet to search about the required information	V2
3.7	Use of computer programs such as Microsoft Excel or other mathematical tool to deal with the chromatographic parameters and evaluations	V2
3.8	Demonstrate good and safe handling of laboratory chemicals, glassware and equipment during experiments	V3

* Program Learning Outcomes

C. Course Content

No	List of Topics	Contact Hours
1	Introduction for separation methods	1
2	Extraction and traditional separation methods	5
3	-An introduction to chromatographic separations -Main fundamentals in chromatography methods -Classification of chromatographic methods -Chromatographic properties and evaluation -Applications of chromatography	3
4	High performance liquid chromatography	3

5	Gas chromatography	2
6	Data analysis	1
Total		15

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1	Knowledge and Understanding		
1.1	Recognize the principles of separation methods	-Lecture -Discussion -Homework -Training and demonstration -Laboratory experiments -Real examples	-Quizzes -Direct questions -Homework assignments -Midterm exam -Final exam
1.2	Describe the differences between traditional and instrumental separation techniques		
1.3	Outline the most important extraction methods and recognize their principles		
1.4	Recall knowledge of the fundamental aspects of the chromatographic techniques		
1.5	Define the most useful separation techniques such as GC and HPLC		
1.6	Describe the mechanism of separation and elution modes		
1.7	Define and describe the most important parameters in the chromatograms resulted from the separation technique		
1.8	List the most important application areas for GC and HPLC		
1.9	Name the most suitable separation method for specific compounds and matrices		
2	Skills		
2.1	Compare and differentiate between separation techniques	-Discussion -Homework -Solving problems -Laboratory experiments -Connect of the knowledge with the real examples	-Quizzes -Direct questions -Homework assignments -Midterm exam -Laboratory reports -Final exam
2.2	Summarize and diagram the most important components of GC and HPLC systems		
2.3	Calculate the most important parameters extracted from separation process		
2.4	Interpret and evaluate chromatograms resulted from the separation technique		
2.5	Justify the proper separation tool for specific compounds		
3	Values		
3.1	Work independently and in group	-Solving problems with group -Discussion -Writing laboratory reports -Provide these programs for students -Training the students -Encourage students to collect information	-Evaluating individual works -Homework assignments -Evaluating laboratory reports -Observation -Demonstration -Short problems and practical exams
3.2	Demonstrate and analyze separation problems with group		
3.3	Communicate ideas to other students in the laboratory		
3.4	Use standard laboratory equipment and modern instrumentation		
3.5	Show leadership and creativity skills		
3.6	Use of computer and internet to search about the required information		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.7	Use of computer programs such as Microsoft Excel or other mathematical tool to deal with the chromatographic parameters and evaluations	through university provided Wi-Fi -Perform laboratory experiments individually and in groups	
3.8	Demonstrate good and safe handling of laboratory chemicals, glassware and equipment during experiments		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm exam	6	20
2	Assignment, research, discussion and homework's	6-15	10
3	Laboratory reports, quizzes and practical exams	---	30
4	Final Exam	16-17	40
5			

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- Office hours: 4 h/week
- Laboratory assistance

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Ibrahim Al-Zamil, "Analytical Chemistry, Instrumental Analysis" 5 th Ed., Al-Khriqi Publisher, 2015.
Essential Reference Materials	None.
Electronic Materials	-Web of Science, Elsevier Academic Press. -Encyclopedia of chemistry and chromatography.
Other Learning Materials	-All lecture notes are available on the web site of the course teacher. -Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, Analytical Chemistry, 7th ed., 2013, Wiley, USA. -Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis, 7th ed., 2018, Cengage Learning, USA. -Kevin Robards, Paul R. Haddad, Peter E. Jackson, Principles and Practice of Modern Chromatographic Methods, 2012, Elsevier Academic Press, Netherlands.

2. Educational and research Facilities and Equipment Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	-Lecture hall for 30 students equipped with modern teaching technology (projector, smart board, computer and internet) -Laboratory should be supplied with the related chemicals, glassware and the required instruments

Item	Resources
	-Laboratory in accordance with the rules of safety and body protection accessories should be available to all students
Technology Resources (AV, data show, Smart Board, software, etc.)	-The presence of computer, smart board and internet access in the in classrooms -E-podium & data show available in all lecture room
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-The presence of chemicals and standards used in analytical experiments -The presence of related analytical equipment and instruments such as GC, HPLC, separation columns and accessories, pH meter, analytical balance, ...etc.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Strategies for Obtaining Student Feedback on Effectiveness of Teaching	Students	-Course evaluation by students -Student faculty meeting -Student questionnaires
Teaching	Instructor or Department	-Revision by the analytical chemistry regular committee meeting -Survey of the graduated students

Evaluation Areas/Issues (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	